

Outcomes of Open Reduction and K-Wire Fixation of Lateral Humeral Condyle Fractures in Children Through Modified Anterolateral Henry Approach to the Elbow

Zulfiqar Ahmed¹, Muhammad Imran Haider¹, Muhammad Iqbal Buzdar², Azhar Rashid², Muhammad Ishfaq² and Ghulam Qadir Khan²

ABSTRACT

Objective: To determine the outcomes of open reduction and K-wire fixation for displaced lateral humeral condyle fracture in children through modified anterolateral Henry approach to elbow.

Study Design: Prospective/observational study.

Place and Duration of Study: This study was conducted at the Department of Orthopedics, Quaid-e-Azam Medical College/BV Hospital/ Civil Hospital, B/pur and NMU/Nishtar Hospital, Multan from August 2017 to Jan. 2020.

Methodology: Twenty eight children of both genders with neglected humeral condyle fractures were enrolled in this study. Patients' age range was from 3 to 12 years. Patient's demographics including age, sex and cause of fractures were recorded. All patients underwent open reduction and K-wire fixation through modified anterolateral Henry approach to the elbow. Functional outcomes were examined at follow-up.

Results: Twenty two (78.57%) were males while 5 (21.43%) were females. Falling was the commonest cause of fracture found in 15 (53.57%) patients. All the patients achieved satisfactory range of motion. 20 (71.43%) patients showed excellent, 4 (14.29%) showed good, 3 (10.71%) showed fair and 1 (3.57%) showed poor outcomes. 01 (3.57%) patient developed avascular necrosis of the fractured lateral condylar fragment, 01 (3.57%) patient had premature closure of physis and pin tract infection found in 2 (7.14%) patients.

Conclusion: Open reduction and K-wire fixation through anterior (Henry) approach is safe and effective surgical modality for lateral humeral condyle fractures especially in children especially in old neglected cases.

Key Words: Lateral humeral condyle fracture, Open reduction, Anterolateral (modified Henry) elbow approach, K-wire, Range of motion, Union, Complications

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INTRODUCTION

Fracture of the lateral condyle of humerus constitute around 13-18% of elbow injuries, with the peak incidence occurring at the age of 6-7 years. The displaced fracture is considered as 'fracture of necessity' and it is generally agreed that it should be treated by osteosynthetic procedures.¹ These fractures could occur by either a pull-off injury, in which avulsion of the lateral condyle occurs at the origin of the extensor/

supinator musculature when a varus stress is applied to the extended elbow with the forearm supinated (the most common mechanism of injury), or a push-off injury, in which a fall onto the extended hand affects the radial head against the lateral condyle, causing the fracture.²

The most often used classification (Jacobs classification) of lateral humeral condyle fractures is based on the amount of displacement between the fragments, Type I has <2 mm displacement of the metaphyseal fragment, Type II has 2-4 mm displacement, and Type III, is completely displaced with rotation. The fracture occurs from falling on the outstretched arm with the elbow supinated, placing a varus stress on the elbow. Non-displaced or minimally displaced Type I fractures can easily be treated with a cast, as can some Type II fractures.³ However open reduction and fixation with K-wires is the treatment of choice for most type 2 and type 3 fractures because it prevents complications that arise due to unreduced or non-united fracture.^{4,5}

Fresh injuries with displaced and rotated fracture fragments can be anatomically reduced and fixed easily

¹. Department of Orthopedics, QAMC/BV Hospital, Bahawalpur.

². Department of Orthopedics, Nishtar Medical University and Hospital Multan.

Correspondence: Dr. Zulfiqar Ahmed, Assistant Professor of Orthopedics QAMC/BV Hospital, Bahawalpur.

Contact No: 0300-9683382

Email: drzulfiqarahmednasir@gmail.com

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and accurately through traditional lateral approach but in case of neglected and old fractures the reduction and direct visualization of the fracture fragment ends for accurate and anatomical reduction due to its intra-articular nature becomes very much difficult through traditional lateral approach. The late presentation of these fractures poses multiple difficult and challenging problems. The fractured surfaces become sclerosed, the fracture fragments covered and fracture gap filled with fibrous tissue, the muscular attachments become shortened and contracted thus making derotation and anatomical realignment/reduction very difficult through traditional lateral approach. Excessive soft tissue dissection done in order to access the fracture site in order to achieve good anatomical reduction through lateral approach may lead to loss of blood supply of the fracture fragment followed by avascular necrosis of the fragment^{6,7} or the displaced & rotated fracture fragment may itself get completely detached and free from its muscular attachment. However, complications associated with this fracture such as non-union, premature physal closure, lateral condylar overgrowth, stiffness, cubitus valgus/varus, avascular necrosis and tardy ulnar nerve palsy may arise after surgical or conservative treatment.⁸

We conducted present study to examine the functional outcomes of open reduction and K-wire fixation for the management of lateral condyle humeral fractures in children through modified anterolateral Henry approach to the elbow.

MATERIALS AND METHODS

This study was conducted at Orthopedic Complex and Civil Hospital of the Quaid-e-Azam Medical College Bahawalpur and NMU/Nishtar Hospital, Multan from 1st August 2017 to 31st January 2020. Twenty eight children of both genders with neglected humeral condyle fractures were enrolled in this study. Patients ages were 3 to 12 years. Patient's demographics including age, sex, cause and site of fractures were recorded after taking informed written consent from all the parent/guardians of the patients. Patients with previous surgery of elbow fracture and those with no consent were excluded from this study.

Antero-posterior & lateral view x-rays were obtained before planning for surgery (Fig-1). All the patients received surgical treatment with open reduction and K-wire fixation through modified Henry anterolateral approach to the elbow joint. All patients were operated in supine position under general anesthesia. Pre & post-operative parenteral antibiotics were given to all the patients. Tourniquet was applied at proximal arm to achieve bloodless field. Skin incision started at a point proximal and lateral to the biceps tendon, extended distally and medially along the medial border of brachioradialis to end into the proximal forearm. Plane was developed between brachioradialis and radial nerve

laterally and brachialis along with biceps tendon & pronator teres medially. Anterior surface of distal humerus metaphysis exposed. Joint capsule opened longitudinally anteriorly. Intra-articular fibrous tissue excised, displaced fracture fragment freed from adhesions and fibrous tissue, derotated as needed, then reduced (Fig-2) and fixed with two or three K-wires placed at angle. Reduction status evaluated and confirmed per-operatively by radiology, capsular incision repaired, wound closed in layers over drain after releasing the tourniquet and securing the hemostasis. Long arm back splint given. drain removed within 48 hours. Finger movements started to the tolerance. Post-operative x-rays (Fig.3) obtained. Stitches removed at first follow up after 02 weeks and subsequent x-rays & clinical evaluation done at 06 weeks, 12 weeks and along with range of motion exercises which were started at appropriate stage after removing the back splint on ascertaining the status of fracture union. Follow-up clinical evaluation and post-operative x-rays (Fig-4) done at 06 and 12 months. Functional outcomes were examined according to the Agarwal et al criteria. All the data was analyzed by using SPSS 24.

RESULTS

There were 23 (82.14%) males while 5 (17.86%) were females. Five (17.86%) patients were ages <5 years, 16 (57.14%) patients were ages 5 to 8 years and 7 (25%) were ages 9 to 12 years. Falling from height was the commonest cause of fracture found in 17 (60.71%) patients followed by RTA 6 (21.43%), sports related injury in 4 (14.29%) patients and 1 (3.57%) patient had other. According to time since injury to surgery 16 (57.14%) patients had <5 weeks while 12 (42.86%) had 5 to 10 weeks.

Table No. 1: Demographics of all the patients

Variable	No.	%
Gender		
Male	23	82.14
Females	5	17.86
Age (years)		
<5	5	17.86
5 – 8	16	57.14
9 - 12	7	25.0
Aetiology		
Falling	17	60.71
RTA	6	21.43
Sports	4	14.29
Other	1	3.57
Time since injury to surgery (weeks)		
<5	16	57.14
5 - 10	12	42.86

As per Jacob classification 15 (53.57%) had type II and 13 (46.43%) had type III fractures (Table 1). All the

patients achieved satisfactory range of motion. 20 (71.43%) patients showed excellent, 4 (14.29%) showed good, 3 (10.71%) showed fair and 1 (3.57%) showed poor outcomes (Table 2). According to the complications noted, 01 (3.57%) patient developed avascular necrosis, 01 (3.57%) patient had premature closure of physis and pin tract infection found in 02 (7.14%) patients (Fig-5).

Table No. 2: Functional outcomes at final follow up

Outcome	No.	%
Excellent	20	71.43
Good	4	14.29
Fair	3	10.71
Poor	1	3.57



Figure No.1: Pre-operative



Figure No.2: Per-Operative



(3)

Figure No. 3: Post-operative X-ray



(4)

Figure No.4: Post-operative healed fracture

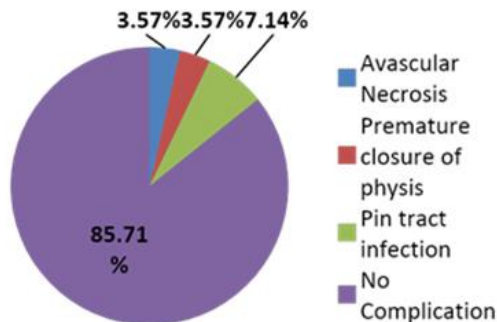


Figure No. 5: Frequency of postoperative complications

DISCUSSION

Neglected fractures of humeral condyle are among the commonest fractures in children of age 03 years and above. In Pakistan these types of fractures usually present late and this leads to develop severe complications. Surgical treatment for neglected humeral condyle fractures is considered a treatment of choice due to its high success rate and fewer complications.^{9,10} Displaced fracture of lateral humeral condyle in children is considered as ‘fracture of necessity’ and deserves appropriate treatment. We conducted present study to examine the functional outcomes of open reduction and K-wire fixation for the management of lateral humeral condyle fractures in children through modified anterolateral Henry approach for elbow. In this regard 28 patients were enrolled. Majority of patients 82.14% were males while 17.86% were females. The results showed similarity to other previous studies in which male patient population was high 70% to 90% as compared to females.^{11,12}

In our study we found that majority of children 57.14% were ages 5 to 8 years followed by 25% had ages 9-12 years. Studies demonstrated that majority of patients with elbow fractures were ages 3 to 7 years.¹³

In present study falling from height was the commonest cause of fracture found in 17 (60.71%) patients followed by RTA 6 (21.43%), sports related injury in 4 (14.29%) patients and 1 (3.57%) patient had other. A study conducted by Pant et al¹⁴ reported that falling from height found in 55.5% followed by sports and traffic accidents.

We found at final follow-up that 20 (71.43%) patients showed excellent, 4 (14.29%) showed good, 3 (10.71%) showed fair and 1 (3.57%) showed poor outcomes. A study conducted by Mahar et al¹⁵ reported in their study that 29% patients had excellent, 16.1% had good, 9.7% had fair and 45.1% had poor functional outcomes after surgical management of neglected humeral condyle fractures by open reduction and K-wire fixation.

Another study by Sial et al¹⁶ regarding outcomes of open reduction and K-wire fixation of displaced lateral condyle fractures of the humerus reported 54.4% patients had excellent, 18.18% had good, 13.64% had fair and 13.64% had poor functional outcomes.

Ghosh et al¹⁷ reported that 60% patients received full range of motion who underwent open reduction and internal fixation for lateral condyle fractures of humerus.

In present study we found that 1 (3.57%) patients developed avascular necrosis and elbow stiffness, 1 (3.57%) patient had premature closure of physis and 2 (7.14%) patients had pin tract infection. These results were comparable to many of previous studies.¹⁸⁻²⁰

CONCLUSION

Open reduction and K-wire fixation is safe and effective surgical modality for lateral humeral condyle fractures in children even in cases presenting late. Keeping in view the difficulty of soft tissue dissection

and anatomical reduction in case of late presenting patients, instead of using traditional lateral approach, we opted for modified anterolateral Henry approach for elbow to directly visualize the fracture site and status of fracture reduction. Overall 85.72% patients showed excellent functional outcomes and only few patients developed complications.

Author's Contribution:

Concept & Design of Study: Zulfiqar Ahmed
 Drafting: Muhammad Imran Haider, Muhammad Iqbal Buzdar
 Data Analysis: Azhar Rashid, Muhammad Ishfaq, Ghulam Qadir Khan
 Revisiting Critically: Zulfiqar Ahmed, Muhammad Imran Haider
 Final Approval of version: Zulfiqar Ahmed

Conflict of Interest: The study has no conflict of interest to declare by any author.

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